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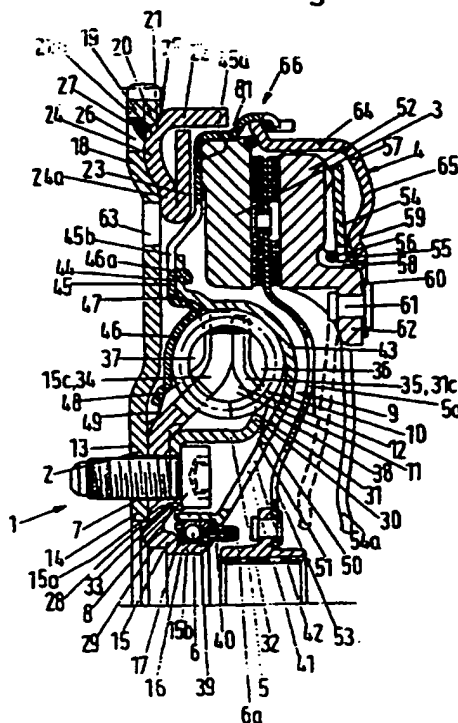
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(54) Dual-mass flywheel

(57) At least two relatively rotatable flywheel masses 2, 3 work against the effect of a damping device 9 with circumferentially acting energy accumulators 10. Of the flywheel masses one (the first, 2) may be attached to the driven shaft of a combustion engine, and another (the second, 3) may be attached to the drive shaft of a gear box through a friction clutch 4. The damping device 9 has at least one input part and one output part, which carry abutment regions for the energy accumulators 10. The input part of the damper is connected rotationally fast with the first flywheel mass 2. The first flywheel mass consists essentially of a radial flange-like component 13, which carries radially outwardly an axial extension 22 extending in the direction of the second flywheel mass and a starter ring gear 19, and the second flywheel mass 3 is at least partly surrounded by the axial extension 22.

Fig.1



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Fig.3

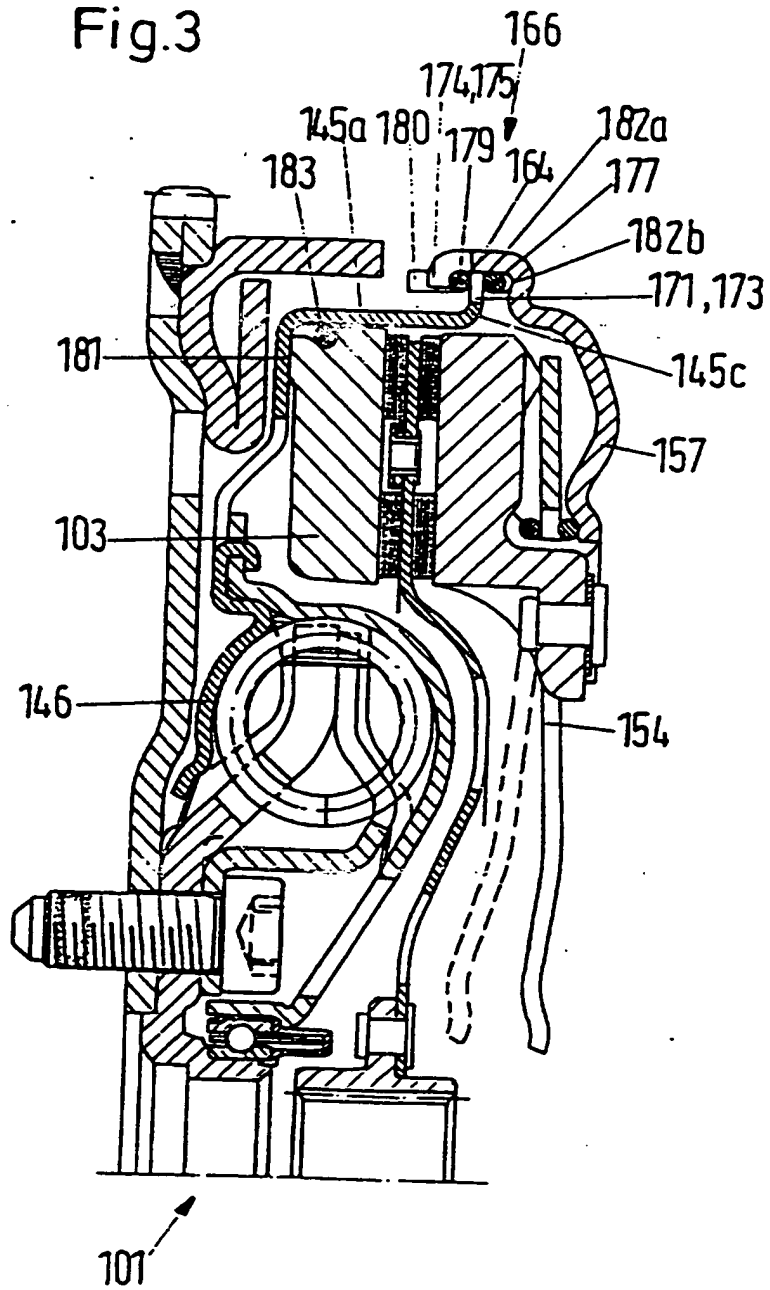


Fig.4

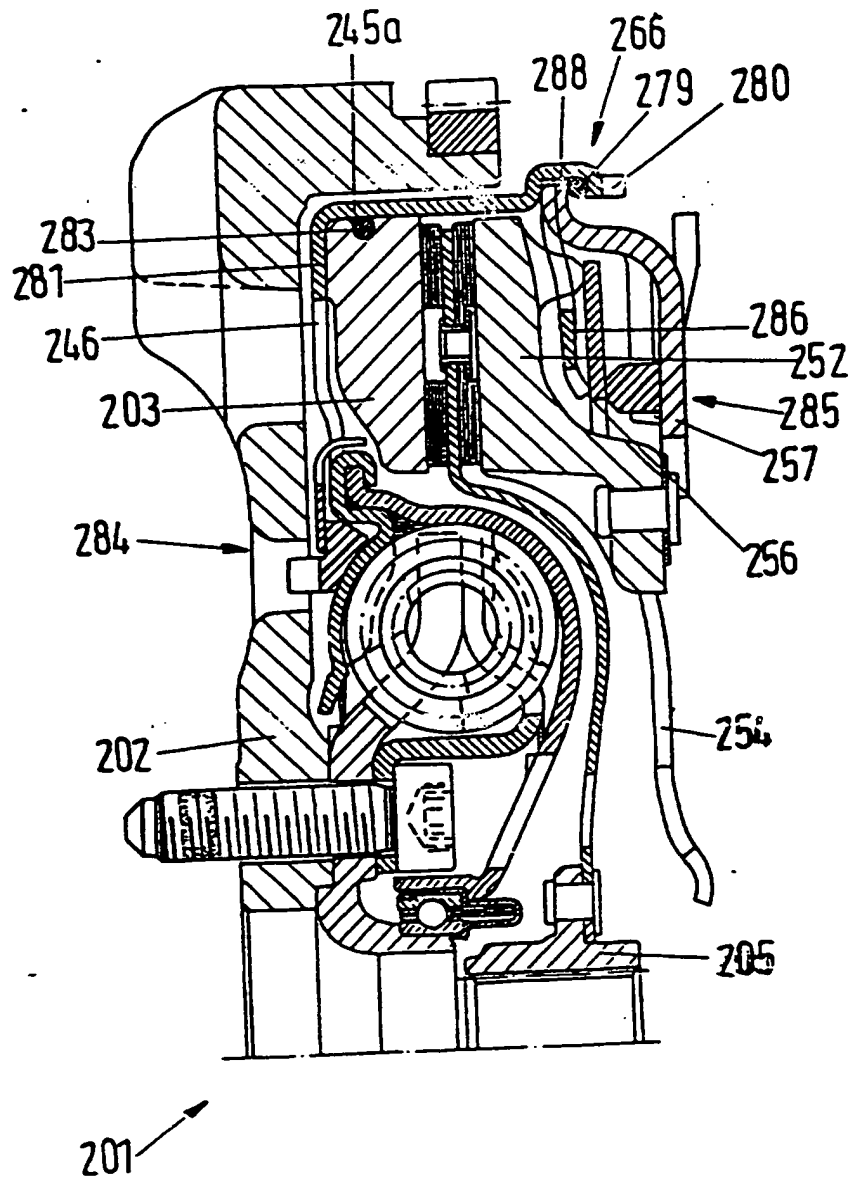


Fig.5c

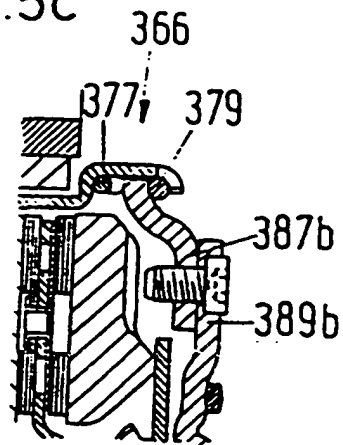


Fig.5a

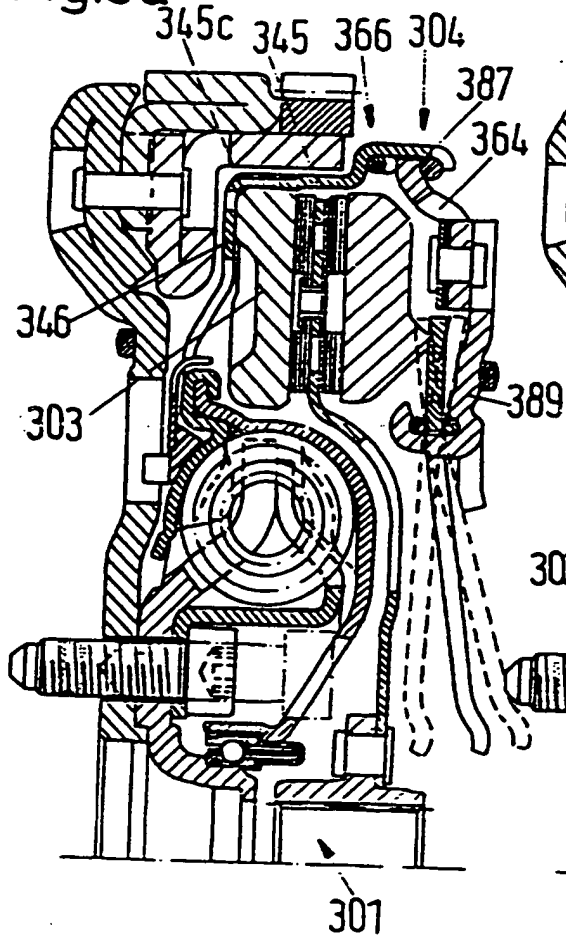


Fig.5b

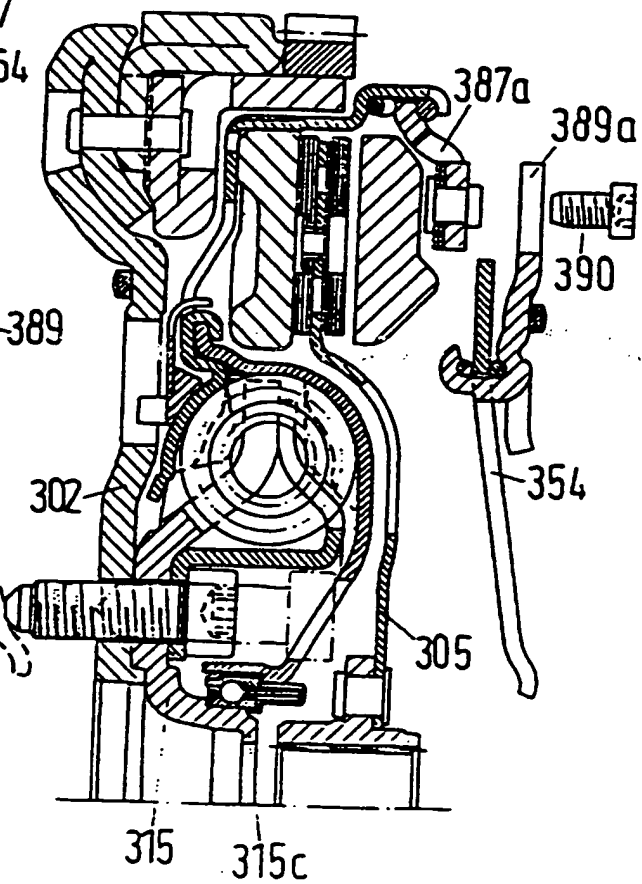


Fig.6a

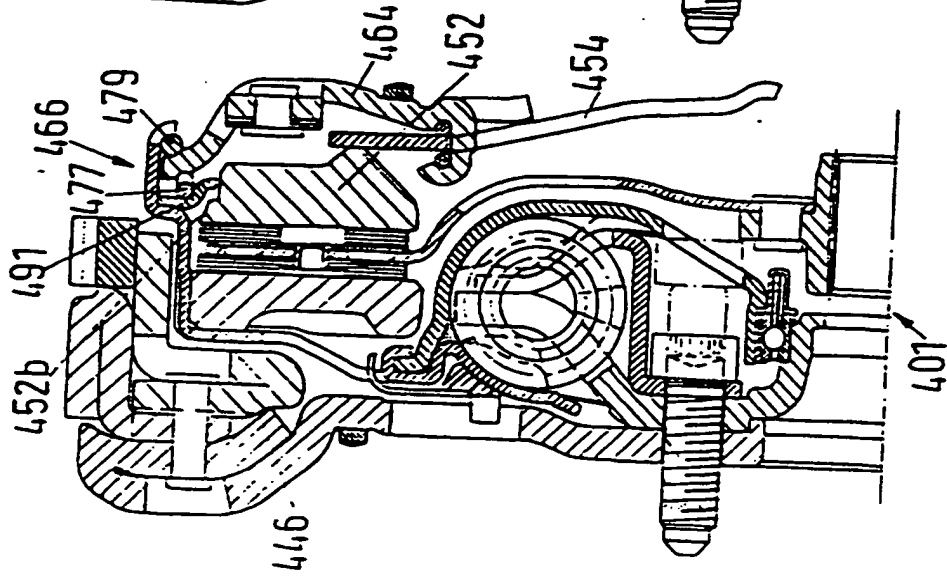


Fig.6b

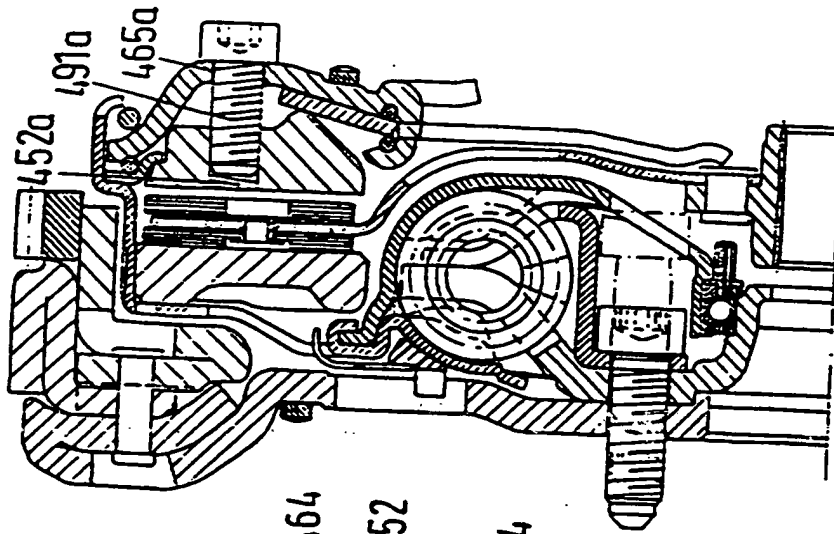


Fig.6c

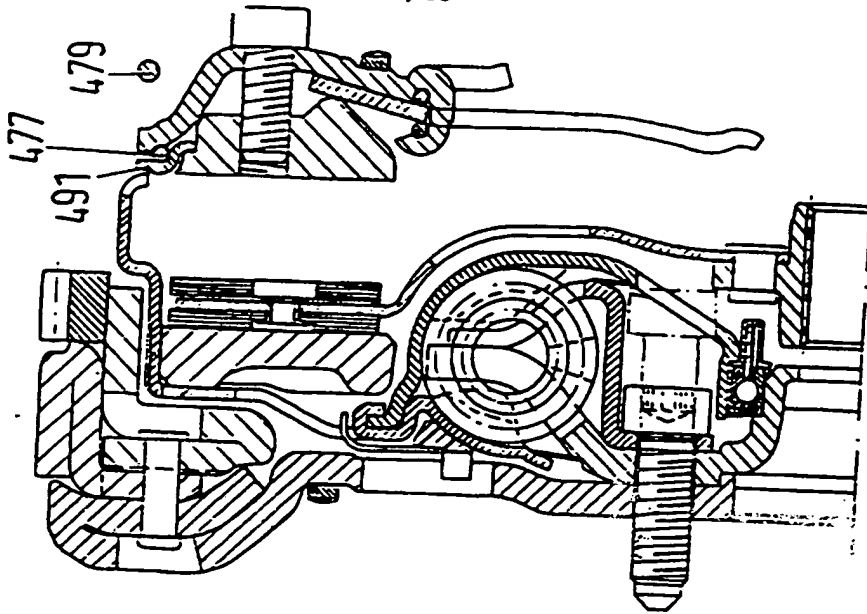
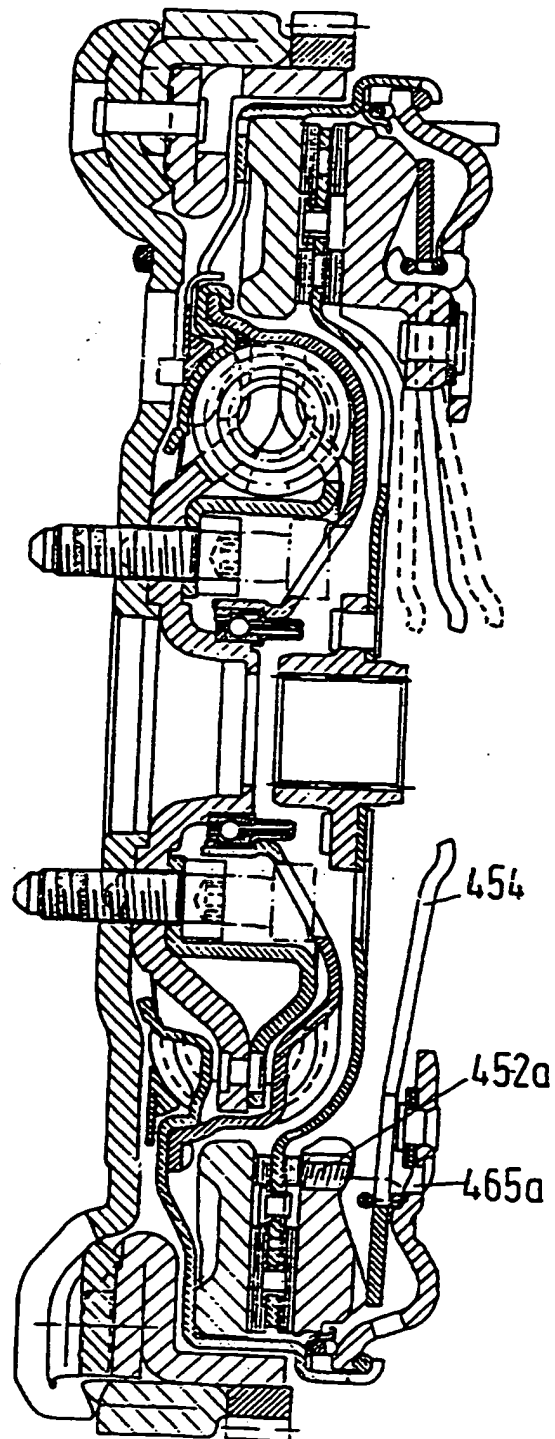


Fig.6d



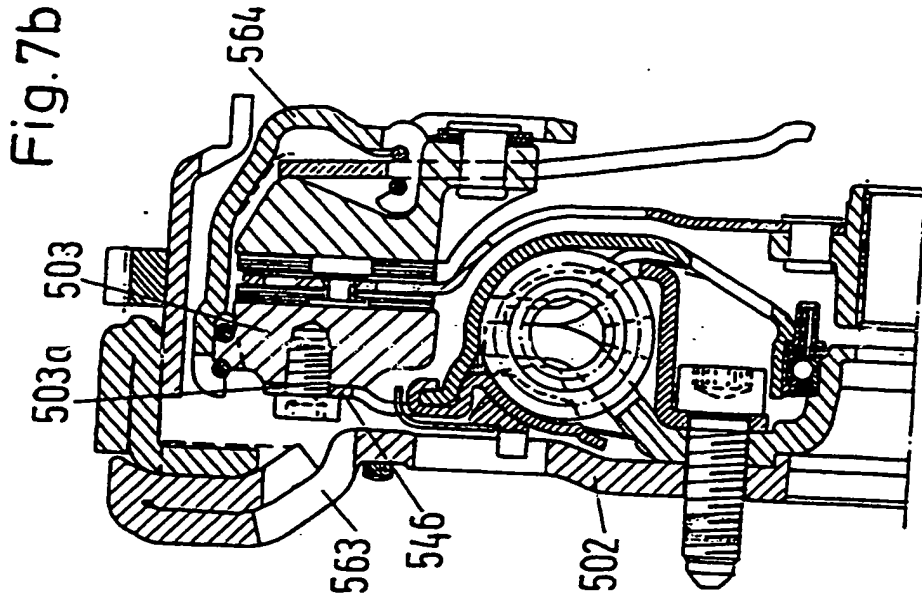
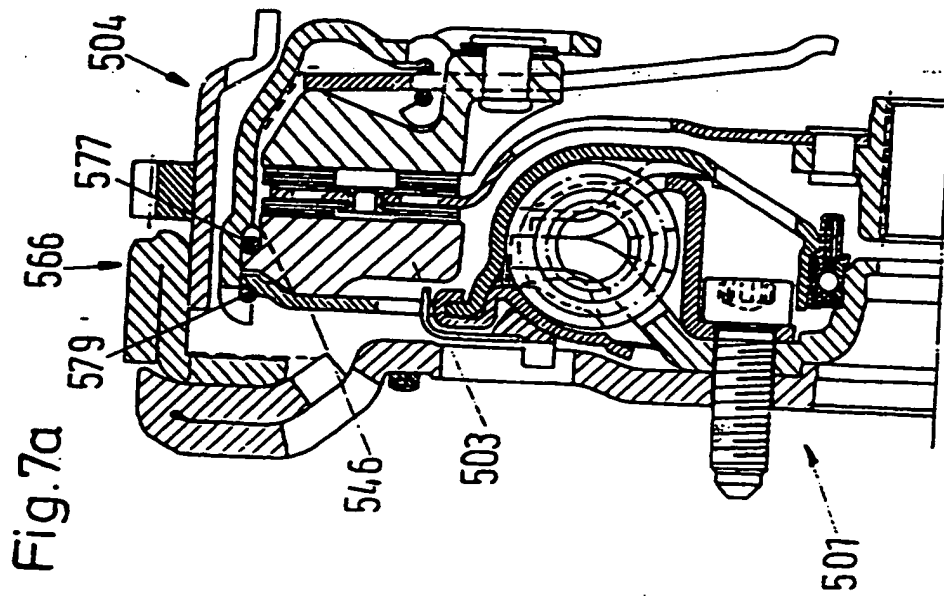
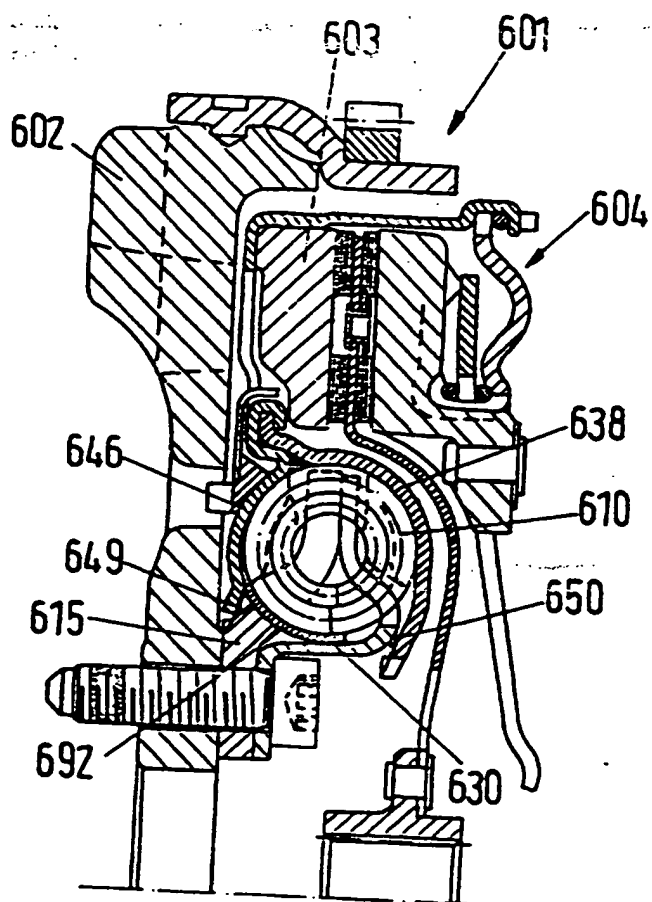
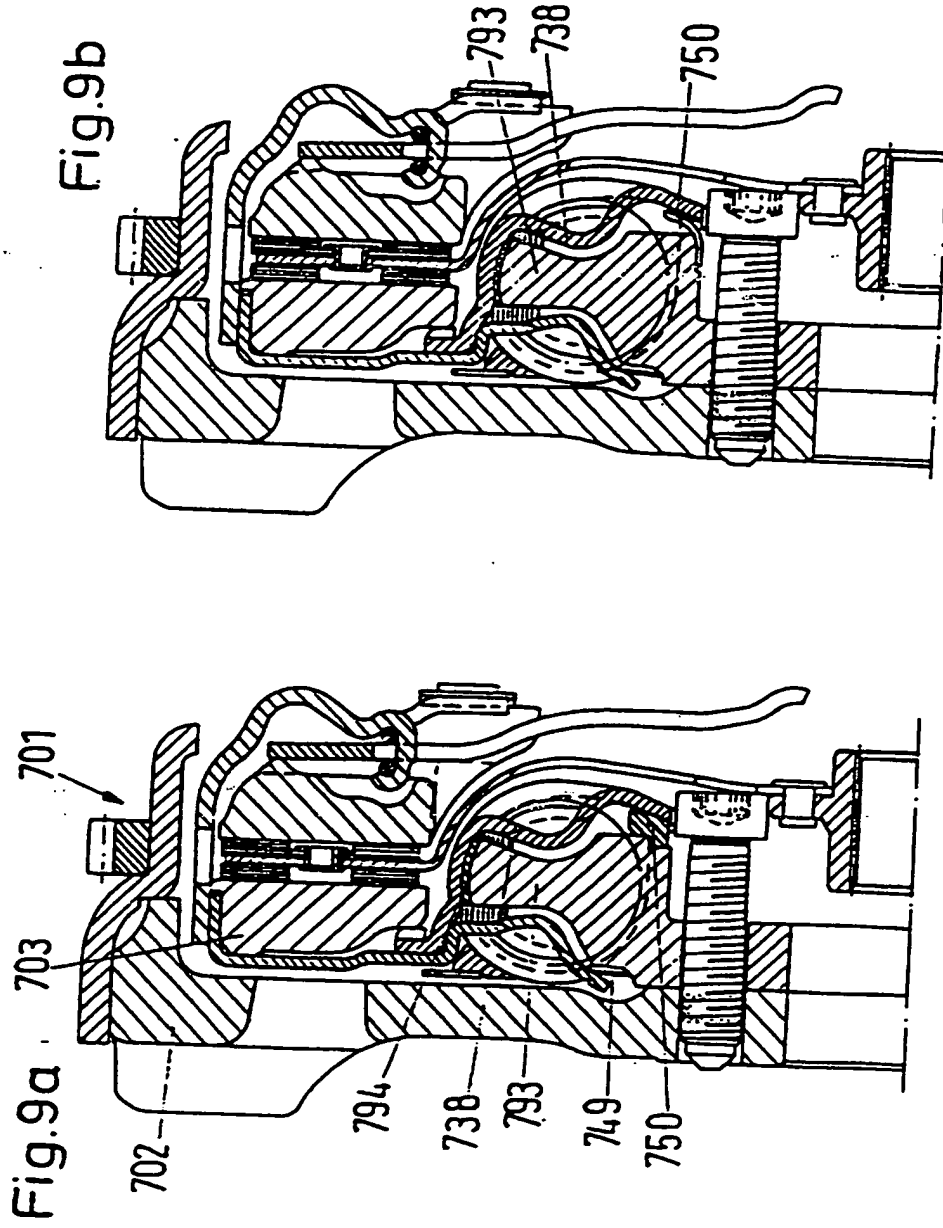


Fig.8





Torque transfer device

5 The invention concerns a torque transfer device, with at least two flywheel masses, rotatable relative to one another through a bearing against the action of a damping device with energy accumulators acting in a circumferential direction. Of the flywheels one (the primary flywheel mass) may be attached to the driven shaft of a combustion engine, and another (the secondary flywheel mass) may be connected to the input shaft of a gear box through a friction clutch.

10 The purpose of the above invention is to make torque transfer devices which are distinguished by their small size both in axial and radial directions. Furthermore, the aim of the invention is to increase the life span of this type of torque transfer device and thus enable the device to have reliable applications such as in motor vehicles.

15 A further fundamental aim of the invention is to allow the torque transfer device to be fastened to the output shaft of a combustion engine as easily as possible. Also, both reasonably inexpensive and economical production and assembly, as well as a simpler and faster method of replacement (for example when renewing worn components), should make this kind of torque transfer device possible. Moreover, these devices, with a range of various different types, should open the way to making the largest possible effective diameter for the friction clutch and should keep the overall dimensions of the whole unit down by using just one requisite diameter. This would mean that this kind of torque transfer device could be used even where space was severely restricted, for instance in vehicles with a built-in transverse front engine.

In addition, an objective of the invention is to reduce the number of individual components and also to save on the natural resources by using the smallest amount of materials possible and by making the least amount of waste possible. The environment may also be helped by a reduction in the manufacturing processes, by making savings on energy and by cutting down on production extras which have been used up until now.

10 A further aim of the invention is to protect the components of the torque transfer device from the effects of extreme forces and thus to prevent any of these extreme forces being passed on to the downstream gear box of the torque transfer device or into the drive train.

15 According to the invention, there is provided apparatus for transmitting torque, comprising: a first flywheel connectable with a rotary output element; a second flywheel rotatable with as well as relative to said first flywheel about a common axis and connectable with a rotary input element; and means for opposing rotation of said flywheels relative to each other including at least one damper having energy storing means acting in a circumferential direction of said flywheels, said at least one damper constituting a torque path between said flywheels, wherein the damper has at least one input party and one output part, which carry abutment regions for the energy storing means and the input part of the damper is connected rotationally fast with the first flywheel, wherein the first flywheel consists essentially of a radial flange-like component, which carries radially outwardly an axial projection extending in the direction of the second flywheel as well as a starter gear ring, and the second flywheel is at least partly surrounded by the axial projection.

It can be an advantage to make the disengageable connection a component of the slip clutch.

5 It can be particularly effective if at least a substantial amount of energy needed for the slip clutch is applied via the clutch pressure spring(s).

10 One particularly effective form of this torque transfer device in accordance with the invention allows for the friction clutch to be a plate spring clutch.

15 Particular benefit can be gained if at least one friction surface of the slip clutch is positioned on the back pressure plate of the friction clutch, in the region of the radial extension of this friction surface, for the friction clutch.

20 One particularly effective arrangement of the torque transfer device, in accordance with the invention, comprises one exclusively frictional engagement of the counter pressure plate, at least in a circumferential direction.

25 Moreover an, in the circumferential direction, exclusive frictionally engaged embodiment of the friction clutch can prove particularly effective.

30 It can be beneficial to have a releasable connection between the cover of the friction clutch and one of the supports of the counter pressure plate. It can be equally as effective if the support engages a collar of the cover from behind, or if the cover (in other configurations) engages a collar of the support from behind.

35 For the type of torque transfer device according to this

invention, it can be useful to have both the radial section and the collar positioned and mated in such a way that the support and cover can be pushed over one another axially, so that the smallest inner diameter of the radial section is smaller than the greatest outer diameter of the collar.

It can prove effective to use an open wire ring as the type of locking component in the releasable connection, with the wire ring being prevented from twisting.

In an advantageous manner this prevention of any twisting can be achieved by offset ends of the wire ring.

It can be useful to have the wire ring positioned on the tongues of the radial section on one side and on the teeth of the collar on the other side.

Similarly, it can be especially effective if further axial energy is applied to the friction clutch in addition to the axial energy of the clutch pressure spring. In most cases it is very effective if an undulating spring or ring is positioned between the cover of the friction clutch and the counter pressure plate, and also if a sensor spring from an adjusting device can be used.

One particularly effective configuration positions an energy storage element between the collar and either the support or cover of the friction clutch on the side of the collar opposite to the wire ring, so that the energy storage element can apply an axial force to the wire ring.

In general, the type of torque transfer device as described in this invention benefits if the support plate has impingement areas for the active energy accumulators

within the perimeter.

5 Particular advantage is gained if the energy accumulators acting in a circumferential direction are positioned radially inside the friction surface of the friction clutch.

10 For this invention of a torque transfer device there is an advantage if the circumferentially acting energy accumulators are positioned in a mainly closed chamber. The chamber can be at least partially filled with either a viscous medium (such as oil or grease) or with a dry lubricant (for example graphite).

15 It is particularly useful to have the chamber extending in a circumferential direction.

In addition, it can be quite practical if the support plate forms the chamber.

20

One especially effective configuration of this type of torque transfer device contains a friction device in a position parallel to the circumferentially acting energy accumulators. Of particular good effect is the positioning of the friction device between the primary flywheel mass and support plate, and the positioning of the friction device in the radial region of the chamber or the energy accumulators.

25

30 It can prove beneficial if a friction element is, or several friction elements are, fitted on the support plate so that in turn friction is produced between the friction element(s) and the support.

35

It can also be effective if synthetic materials such as

PTFE, PEEK or PA6.6 are used for the friction element(s).

5 It is also useful if the friction device is effective over either the whole region of the rotational range or one part of the rotational range.

10 For this type of torque transfer device it is useful if the friction element(s) is (are) biased towards the support plate with axial force. Then it can be useful if the axial force can be applied by a plate spring-like component, so that in turn the plate spring-like component is connected to the support plate. An especially effective connection can be made between the plate spring-like component and the support using a locking connection, 15 for example in the form of either a snap connection or a bayonet locking. Furthermore, it can prove useful if the friction element(s) is (are) at least indirectly controlled towards a component of the first flywheel mass.

20 Beyond this, the invention concerns a torque transfer device characterised by having a torque limiting device of the type seen in the force transmission path. It is also characterised by having the torque path (in this case from the engine) passing from the first flywheel mass by means of a flange, which is inserted into the chamber and 25 which impinges on the energy accumulators, and into the energy accumulators themselves. From there the torque flows on into the friction surface of the torque limiting device, which is designed radially outside of the energy accumulators and which is placed in the region containing 30 the radial extension of the friction surface of the friction clutch, and then finally it passes on into the second flywheel mass.

35 It becomes particularly effective if the torque transfer

device has a friction clutch and a clutch disc all as one unit which is able to be pre-assembled and which can then be screwed onto the driven shaft of the combustion engine, from the side opposite the engine, using fixing screws. However, it is even more advantageous if the fixing screws are contained within the unit, as they then can be kept securely within the unit.

A torque transfer device in accordance with the invention can be provided in an advantageous manner with a friction clutch as a so-called compressed clutch, or equally with the friction clutch as a so-called pulled clutch.

With the aid of the Figures, the invention will be described in more detail.

Figure 1 is a simplified sectional drawing through a torque transfer device according to the invention;

Figure 2 is an enlarged drawing of part of Figure 1;

Figure 3 shows a design variant of a torque transfer device in accordance with the invention; and

Figures 4 to 9 show further variants of a torque transfer device in accordance with the invention.

Figure 1 shows part of a flywheel in halves 1 (the original design of which is described in different versions in the German patent applications P 43 20 381 and P 43 11 908) to which particular reference is made here and the content of which is incorporated by reference into part of the following description. This type of flywheel 1 comprises a first or primary flywheel mass 2, which can

be attached to a crankshaft of a combustion engine (not shown), and a second or secondary flywheel mass 3. A friction clutch 4 is fixed on this secondary flywheel mass 3 with a clutch disc 5 located between, through which a gear box (also not shown) can be connected or disconnected. This clutch disc 5 is clearly shown and is merely an example. It can take other structural forms containing the friction and/or damping elements, or can even be equipped with a spring cover.

In this case the flywheel masses 2 and 3 are journalled relative to one another by a bearing 6 with the interposition of components connected firmly to them. The bearing in this example is positioned radially within bores 7 for the introduction of fixing screws 8, allowing the assembly of the first flywheel mass 2 or the whole torque transfer device 1 onto the driven shaft of the combustion engine. The single-row ball bearing 6 shown has a sealing cap 6a with a lubricant chamber, so that the sealing cap 6a also serves as a thermal isolator, so reducing the heat transfer from the second flywheel mass 3 to the bearing 6, and/or preventing a thermal bridge. Between the two flywheel masses 2 and 3 is a damping device 9 which in this instance acts on helical compression springs 10, which themselves are positioned in an annular space 11 forming a roughly torus-shaped space 12. The helical springs 10 which are shown and used in this instance can be replaced by suitably constructed alternative energy accumulators or by leg springs for example. The annular space 11 is therefore filled with a dry lubricant (such as graphite powder or something similar), or with a thick viscous material (such as oil or grease).

The primary flywheel mass 2 contains a component 13,

preferably made or drawn from sheet metal, which serves to connect the first flywheel mass 2 or the whole of the divided flywheel 1 to the output shaft of the combustion engine or to a shaft connected thereto. The component 13 forms a flange-like region 14 extending essentially in a radial direction which carries radially inwardly a flange 15. This flange 15 has areas 15a extending in a radial direction with recesses 7, aligned bores or openings for the fixing screws 8. The single roller bearing 6 is fixed with its inner ring 16 to an outer casing or shoulder-piece in the axial end-section 15b of flange 15. The second flywheel mass 3 is supported on the outer ring 17 of the roller bearing of bearing 6.

The radial piece 14 extends radially outwards and passes into a shaped area 18 on the axial side of the combustion engine, which then extends radially outwards itself and forms the starter gear ring 19. Thus the starter gear ring 19, in the outer radial area of the component 13 with deformed and bent material, has its wall on the outer radial section of the housing 13, but with its limb 20 pointing radially inwards. The shaping and/or teeth of the starter gear ring can be formed after the folding of the plate into this shaped metal part. This shaping can be made by cutting processes such as milling or broaching. The shaping of the starter gear ring 19 can also be made by embossing or by using a material flow production process, or even by being pressed out. Another possible manufacturing process for this shaping uses high energy light rays such as lasers to cut them out. It is useful if the sections of metal used at least in the shaping and/or teeth of the starter gear ring 19 are stronger than those used in other regions. Such a partial increase in strength can for example be achieved by inductive strengthening or by case hardening.

To increase the angular momentum of the twin mass flywheel 1 which rotates around its axis, the primary flywheel mass 2 which can be connected to a combustion engine has an inertia ring 21. The inertia ring 21 is made out of a plate body and has one limb 22 pointing in an axial direction and two limbs 23 and 24 pointing in a radial direction, so that the inertia ring 21 has an approximately L-shaped cross-section. The inertia ring 21 is made by folding or bending a piece of metal which is originally straight in its cross-section, as described for example in the German patent application P 43 15 209, which is particularly referred to both here and in connection with the starter gear ring 19, and which in this respect forms at least part of the present application.

The limb 22 stretching in an axial direction butts onto limb 20, which also extends in an axial direction, of the starter gear ring 19 with impingement region 25. By such manufacture of the inertia ring, its shape can be fitted for example to the internal shape of the housing containing the twin-mass flywheel, such as the gearbox bell housing so that no movement can take place.

The free end of limb 22, which stretches in an axial direction, extends away from the combustion engine and by forming either a bend or curve 22a into the radially extending limb 24 of the inertia ring 21. The inertia ring 21 thus butts onto the side (which is opposite to the combustion engine) of pot-like region 18 of the first flywheel mass 2, with this curve 22a and the radial limb 24. Radially within this area limb 24 points in the direction of the secondary flywheel mass 3 towards an axially offset section 24a, which has its wall touching the wall of the second limb 23 extending in a radial

direction. Limb 23 rises above section 24a outwards in a radial direction, and ends at a radial distance from the axially extending limb 22. In the region of curve 22a the inertia ring 21 is firmly connected to the primary flywheel mass 2 by way of several welds 27, which are spread over the perimeter and which are in recesses 26.

Flange 15 is connected centrally to the first flywheel mass 2. It can be centred by using a centering seat 28, for example, which combines with the central recess in section 13. Otherwise the centering, and if necessary the connection, of flange 15 to the first flywheel mass 2 can be achieved by using lugs which can be passed through from the side opposite the combustion engine for example, using part of flange 15. Flange 15 also extends radially inwards to centering seat 29 which helps to centre the split flywheel 1, for example on an engine crankshaft.

Outside its radial area 15a the flange 15 extends radially outwards from the side with the combustion engine so as to reach back into its outer radial area in a radial direction. Inside this outer radial area flange 15 has a second flange 30 firmly attached to it. This connection can result from the drawing of material from flange 15 to make connection lugs. Within this connection flange 30 extends both radially and inwards so that a slight cavity 31 is visible on the side with the combustion engine. Flange 30 extends radially within the cavity 31 over the combustion engine to region 32, which itself extends inwards towards area 33. The radial region 33 touches radial piece 15a of flange 15 and has, like the flange, recesses for the introduction of fixing screws 8, when the side of radial region 33 facing away from the combustion engine can comprise an abutment for the heads of the

fixing screws 8.

5 In the outer radial area and the area of cavity 31 flanges
15 and 30 form impingement regions 34 and 35 for the
energy accumulators in the form of helical springs 10.
10 The impingement regions 34 and 35 are formed by radial
extension arms 15c and 31c, which project into the areas
in between the circumferentially acting energy
accumulators 10. The extension arms 15c and 31c, along
with their impingement regions 34 and 35, are made so that
they fit the spring ends of energy accumulators 10. The
ends of the springs cooperative with the impingement
15 regions 34 and 35 might only show a point of separation
and may perhaps neither be positioned on the above
springs, nor have their ends vertically touching the
central spring axis. This means that the end coils of
energy accumulators 10 actually correspond with any of the
other coils inside the energy accumulators 10, and so are
20 shown to be comparable to a screw with practically the
same gradient. Thus it is possible for these end coils
to be fitted as sprung coils, so that any non-sprung coils
are not used and so that both greater spring capacity and
smaller actual lengths of spring can be used. By
utilising this arrangement of spring coils the spring wire
25 itself must be cut and thus the other operations (for
example the positioning of the last spring coil onto the
one immediately preceding it, and the grinding of the
spring end so that it touches one of the flat abutment
surfaces) can be left out.

30 This type of spring arrangement combined with the
requisite impingement regions is not limited purely to the
example of a twin mass flywheel as given above, but can
be used in all other combinations, such as with dampers.
35 Likewise it is possible to replace both flanges 15 and 30

with just one piece, for example a sintered or forged piece, wherein again the impingement regions 34 and 35 can be fitted to the energy accumulators 10.

5 The two flanges 15 and 30, or indeed one of the replacement sintered or forged pieces, can be made in such a way that they form an additional torsional protector in the impingement areas 34 and 35 of the energy accumulators 10 to prevent the elements 10. Such a torsional protector
10 makes sure that the energy accumulators stay exactly in their original specified position and are unable to turn around their coil axis, for example. This has the advantage that the free spring end coil is always at the same place on the impingement regions 34 and 35, and thus
15 it ensures that the end coils with all their spring properties and volumes are made available to absorb any vibration.

20 The energy accumulators 10 are supported on the other hand on impingement regions 36 and 37. The energy storage element impingement regions 36 are arranged on a first cover plate 38 which is supported radially inside on bearing 6 and/or here on the outer bearing ring 17 of the roller bearing 6, and which radial outwardly supports the
25 secondary flywheel mass 3.

30 In addition, in its inner radial area the cover plate 38 has a shoulder 39, which extends axially to the engine, and which has an inner diameter able to accommodate the outer bearing ring 17 combined with the seal cap 6a. This shoulder has a diameter restriction 40 on the side opposite to the combustion engine, which serves as an axial stop or fixture between cover plate 38 and roller bearing 6. Cover plate 38 extends radially inclined
35 outwards from the cross-section restriction 40 and away

from the combustion engine, and this section 41 extends substantially straight.

5 The straight section 41 contains access recesses 42 which are designed to take the heads of the fixing screws 8, and, in so doing, to fix the screws 8 in a co-axial position on the rotation axis of the twin mass flywheel 1, when the torque transfer device is in neither a fitted nor an installed condition. The straight cover piece 10 section 41 leads radially outwards into area 43 (which is a segment of a circle in cross-section), which is at least substantially conforming to the outer edge of energy storage element 10 and which partly surrounds it axially and radially. A radial piece 44 is connected on to the 15 free combustion engine end of region 43 pointing radially outwards, and is firmly fixed by means of radial piece 45 of the second cover plate 46, which is itself in an axial position between cover plate 38 and the metal housing 13. The two cover plates 38 and 46 are sealed radially by 20 means of an O-ring 47.

The cover plate 46 partly contains the O-ring 47 radially within the radial piece 45 and extends axially away from the side on which the combustion engine is placed into the 25 space contained by cover plate 38. Thus the seal of the ring-shaped chamber 11 and the space 12 is ensured, whilst at the same time cover plates 38 and 46 are both centred to each other. From this point cover plate 46 runs substantially radially inwards and substantially conforms to the outer contour of the energy storage element 10, and 30 it is also extended into the axial housing between the plate part 13 of the first flywheel mass 2 and the flange 15.

35 Radially within impingement regions 37 cover plate 46 has

a region 48 axially facing the combustion engine, on which plate spring 49 lies. Plate spring 49 makes inner radial contact with flange 15, and so forms an inner radial seal for chamber 11. Therefore plate spring 49 can be centred both in the region of cover plate 46 as well as to flange 15. Another plate spring 50 makes a seal for chamber 11 on the inner radial between the flange 30 and the cover plate 38. At this point the outer diameter of plate spring 50 touches the projection 31 of flange 30, and the inner diameter touches cover plate 38 in the region of piece 32 which runs axially from flange 30. To allow plate spring 50 to be centred, cover plate 38 has several centering projections 51 spread around its perimeter which are partially interspersed with material from cover plate 38. Instead of several centering shoulders 51 arranged around the perimeter, it is also possible to use one completely circular piece, or even to centre plate spring 50 relative to the flange 30.

In the region of its outer diameter, the cover plate 46 carries the second flywheel mass 3. To this end the cover plate 46 has an extended radial region 45 which extends over the secondary flywheel mass 3 in a radial direction and becomes at its outer radial end one of the axial regions 45a, which points away from the combustion engine. Cover plate 46 at least partly covers the secondary flywheel mass 3 in an axial direction with this axial area 45a, and it forms a connecting region on the side opposite to the combustion engine, which has yet to be described.

In the inner radial region of the secondary flywheel mass 3 the cover plate 46 has tongues 46a pointing away from the combustion engine in an axial direction, penetrating radial region 44 of cover plate 38 and which are plastically shaped after the assembly of these pieces so that they point radially inwards on the side of the

secondary flywheel mass 3 to firmly connect the plate 46 to the cover plate 38. These tongues 46a are made directly out of the material of cover plate 46, so that an additional flanged metal plate can be dispensed with.

5 Another advantage of this construction can be seen by the reduced heat transfer from the secondary flywheel mass 3 to both cover plates 38 and 46, thus reducing in turn the direct effect on the lubricant. In addition, recesses 45b, in radial region 45 and in a conical extension of
10 cover plate 46, help the cooling effect. Radial regions 45 and 46 are positioned on the side of the secondary flywheel mass 3 (and opposite to the friction surface), so that if a leak should ever occur or if o-ring 47 should fail then the medium or lubricant contained in chamber 11
15 is guided towards primary flywheel mass 2. This stops the effective friction on the linings of clutch disc 5 from being impaired, and so allows the friction clutch 4 to continue to transmit the full torque.

20 As well as the clutch unit (consisting of clutch 4 and clutch disc 5), the twin mass flywheel 1 also forms a unit which is pre-assembled, which is shipped and journalled, and can be mounted both easily and rationally on the crankshaft of a combustion engine. This configuration
25 then allows various processes to be dispensed with such as the otherwise necessary centering of the clutch disc, the processes of positioning the clutch disc and connecting the clutch, the introduction of the centering mandrel, the centering of the clutch disc itself, as well
30 as the insertion of the screws, the screwing on of the clutch and the removal of the mandrel.

Fixing screws 8 can be already mounted and positioned in the drill holes of flange region 14 and flange 15 so that
35 they are effectively kept in a secure position, for

example by resilient means, which are dimensioned so that their holding force will be overcome when the screws 8 are tightened.

5 Clutch disc 5 is clamped in a precentred position between pressure plate 52 and the friction surface of the secondary flywheel mass 3 on a rotational axis of the unit. It is in such a position that the holes 53 designed
10 in clutch disc 5 are arranged in such a way that they allow a screwing-up tool to be used when mounting the whole section or unit onto the driven shaft of a combustion engine. Also, and as can be seen in the various configurations in the drawings, the holes 53 may
15 be smaller than the heads of the fixing screws 8 so that the screws 8 are kept both correctly in position and securely within the unit.

Plate spring 54 also has cutouts or holes for the passage of a screwing-up tool in its tongues 54a, which are not
20 shown in this Figure. These cutouts can form widenings or lengthenings of the slots which exist between the tongues 54a. The openings in plate spring 54 and the holes 53 in clutch disc 5 cover each other in the direction of the axis, and therefore their axially aligned
25 positioning allows access to an assembly tool for tightening the screws 8 and for fixing the whole unit onto the crankshaft of a combustion engine.

Above plate spring 54 the actuatable friction clutch 4 has
30 a pivot bearing 55 on the cover side of the clutch cover 57 and a pivot bearing 56 on the opposite side of the clutch cover 57. Pivot bearings 55 and 56 are formed by wire rings and are held by plates 58 divided at the circumference. The plates 58 are made in one piece with
35 the cover 57, and are made out of the same, but

necessarily shaped, material. On the side opposite to cover 57 the plates 58 at least partly grip the pivot bearing 56 both in axial and radial directions. The connection of pivot bearing 55 radially outside the pivot bearing 55 is ensured by a pressed-in swage 59 in cover 57. Instead of one continuous closed swage 59, several discrete swages can be used if spread around the perimeter. Pressure plate 52, as is shown in the drawings, can at least be fitted in the region of the edges of plates 58 and also in the other regions at the edge of pivot bearing 56. However, as an alternative to the given example, it can also be useful to leave the matching of the plates 61 constant around the whole perimeter.

Leaf spring elements 60 are used for both the torque transfer and for the lifting movement of pressure plate 52. They are connected on one side to the housing or the cover 57 via rivets which are not shown here, and on the other side to pressure plate 52 via rivets 61. The rivetting on pressure plate 52 occurs at pressure plate cams 62 which in this example jut inwards and which are positioned radially inside the friction surfaces of clutch disc 5. Pressure plate cams 62 penetrate plate springs 52 in an axial direction and in the recessed sections so that the leaf spring elements 60 are positioned on the side of cover 57 opposite to the pressure plate 52. This type of leaf spring arrangement is not limited to a divided flywheel, but can also be used with other types of clutches, such as with a conventional flywheel. The necessary recessed sections in the plate spring can be made by removing parts of the plate spring tongues 54a or even by removing complete spring tongues 54a. The plate spring tongues 54a are shaped to fit the edge of the support of the clutch disc 5 and run alongside and

parallel to it for this example pressured clutch construction, with friction clutch 4 in a disengaged position.

5 Alongside the recesses 42 in cover plates 38 and 53 of
clutch disc 5 further openings or passages can be made -
which can help to cool the whole unit - in the region of
clutch covers 57 and 5a in clutch disc 5, or in the
secondary flywheel mass 3 and 63, and in section 13 of the
10 primary flywheel mass 2. If the whole unit is
sufficiently cooled then, amongst other things, this
should prevent any of the thick material (eg grease)
contained in the torus-shaped area 12 from being
excessively heated, which would thus lower its viscosity
15 and cause it to flow. Moreover, an increased thermal load
negatively affects the life span of the whole unit. To
further improve the elimination of any heat, the surfaces
of the secondary flywheel mass 3 and/or in pressure plate
52 can be enlarged, so that they, and the passages already
20 described, can be shaped like a compressor blade.

The clutch cover 57, which is at least indirectly
connected to the secondary flywheel mass 3, consists
essentially of an axial region 64 which is shaped
25 generally as a hollow cylinder, and of the section 65
which at least begins by running radially and in the
region of which the plate spring 54 is pivoted. The axial
region 64 points towards the combustion engine and has a
connecting piece at its free end, which has yet to be
30 described.

Figure 2 is an enlarged and detailed section of Figure 1
and shows the disengageable connection 66 between axial
region 64 of clutch cover 57 and axial piece 45a of cover
35 plate 46. This connection 66 fulfils two purposes.

Firstly, with the help of this connection 66, it is possible for example to dismantle without damage the whole unit - comprising the divided flywheel 1 and the clutch 4 joined onto it - in order to replace clutch disc 5 and, having replaced the worn parts, to easily reassemble it. Secondly, connection 66 serves as a sliding clutch and so protects the whole unit and the downstream drive train from excessive torque loads and over momentum which would otherwise lead to an increased load on either the whole drive train or at least on certain parts of it, if not to their complete destruction.

The axial region 64 of the cover 57 has a radial collar 67 at its end facing the combustion engine, which has two curved regions 68 and 69 running in opposite directions. The axial piece 45a of the cover plate 46, which also acts as a support for the secondary flywheel mass 3, is widened in the diameter facing away from the combustion engine (and connects in an axial direction to limb 22 of inertia ring 21), engages radially around collar 67 with axial section 70 and covers the outer periphery in an axial direction. A tongue region 71 is connected to this axial section 70, which is curved and which has its end 72 facing radially. Therefore tongues 71 and recesses 73 alternate around the edge of the cover plate and support 46, as well as on collar 67 of the clutch cover 64. This collar 67 has teeth 74 pointing outwards on its outer radial region. These teeth 74 alternate with recesses 75 around the edge so that the recesses 75 are bordered inwards, as represented by the dotted line 76. Tongues 71 are thus extended less in the direction of the perimeter than are the recessed sections 75, and the edges of teeth 74 are extended less than those of the recessed sections 73. Furthermore, the inner diameter of the tongue region 71 (at the end 72 pointing inwards) is

greater than the outer diameter of collar 67 at point 76 of the recessed sections 75. This configuration ensures that clutch cover 57 and support 46 penetrate in the region of the connection 66 axially, so that they can be fitted together.

On its inner radial curved region 68 the collar 67 partly surrounds an undulating spring 77, which is shown to have a circular cross-section. This undulating ring or spring 77 is supported in a groove 78 of the secondary flywheel mass 3. On its other side the collar 67 partly surrounds a wire ring 79 with its outer radial curved region 69. The wire ring 79 is in turn supported on the tongues 71 of support 46. Wire ring 79 is open, when viewed around its perimeter, and its ends 80 which originally faced each other are bent in such a way that they point axially away from the combustion engine at an angle of approximately 90 degrees to the plane of the wire ring 79. Moreover, these bent-over ends 80 enter support 46 in the region of the recessed sections 73 between the tongues 71, so that the wire ring 79 is protected from any twisting relative to the cover plate 46.

When it is assembled the secondary flywheel mass 3 is positioned in the body formed by axial piece 45a, and cover plate 46 is already fitted with damping device 9 on the primary flywheel mass. After positioning the clutch disc 5 and the undulating spring 77, the clutch cover 57 is to be slid with the mounted pressure plate 52 and plate spring 54 into the area of tongues 71 or with teeth 74 axially towards the combustion engine, so that collar 67 lies closer to the combustion engine than tongues 71 when viewed axially. In this process both the undulating spring 77 and the plate spring 54 are pretensioned and they exert an axial force which after insertion of the

wire ring 79 and thus making of the connection 66 is taken up by the wire ring 79, as the secondary flywheel mass 3 is supported on its side facing the combustion engine by radial piece 45 of cover plate 46.

5

When engaged in this configuration the axial energies of plate spring 54 and undulating spring 77 are added together, whereas when it is disengaged only the axial energy of the undulating spring 77 is applied. Should the need arise, undulating spring 77 can besides exert a low radial force, so facilitating the centering of the secondary flywheel mass 3 and which also helps to prevent it from falling out of the body formed by axial piece 45a. To make assembly easier, plate spring 54 can be tensioned, and thus kept in a "disengaged position", so that during assembly only the spring force of the undulating spring or ring 77 has to be surmounted.

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In order to dismantle the unit it is only necessary to apply axial energy again so that the spring force of the plate spring 54 and of the undulating spring 77 is overcome, which releases the connection 66 and then allows the wire ring 79 simply to be removed. At this point all that is needed is to move the offset ends 80 relative to each other by using a pair of pliers or something similar, so that the diameter of the wire ring 79 is reduced. The wire ring can then be removed and then the teeth 74 can be moved again through the recesses 73.

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In the assembly method described here, none of the parts - the secondary flywheel mass 3, the clutch 4 or clutch disc with the support 46 - are interlocked in any way. The frictionally engaged connection as shown here forms a slip clutch with the friction surfaces 81 between the secondary flywheel mass 3 and the support 46, and the surfaces 82

between the collar 67 and the wire ring 79. In this configuration therefore the whole friction clutch 4 along with the secondary flywheel mass 3 can be moved in a circumferential direction in relation to the rest of the twin mass flywheel 1 so that any transmission of excessive torsional shocks is hindered from passing to the rest of the drive train. The load transfer ability of this slip clutch is determined by the spring rate of the plate spring 54 and the undulating spring 77 in addition to the choice of friction pairings on the friction surfaces 81 and 32, so that at these points friction linings can also be positioned.

Figure 3 contains components which match or are similar to those parts already described, and which have similar numbers, but which are increased by 100.

The divided flywheel 101 corresponds in the original design with the twin-mass flywheel 1 already described, but has a disengageable 166 of a different design. Thus at the free end of its axial region 145a the support plate 146 forms a collar 145c pointing radially outwards, which in turn has teeth 171 and recessed sections 173 spread around its perimeter. This radial collar 145c is surrounded radially and projected axially by the axial piece 164 of clutch cover 157, which itself has tongues 174 pointing inwards, whilst being spread around the perimeter and alternating with recessed sections 175. The assembly and locking in the region of connection 166 occur in a similar way to that already described, so that undulating spring 177 is positioned in an axial direction between the collar 145c and the clutch cover 157, and so that the wire ring 179 is fitted between the flange 145c and the tongues 174 which point inwards. In this configuration the angled ends 180 of the wire ring 179

point towards the combustion engine.

5 In order to position the secondary flywheel mass 103 in the pot of the support plate 146 formed by the axial piece 145a, a further undulating spring 183 is designed, which is radially pretensioned. Here the slip clutch has friction surfaces 181, 182a and 182b. On the friction surface 181 there is frictional force which is proportional to the pressure of the plate spring 154, and on the friction surfaces 182a and 182b there is also frictional force, which is proportional to the axial force of the undulating spring 177. Therefore, either friction surface 182a or friction surface 182b, or even both is or are used as the friction surfaces, according to the prevailing conditions.

20 Instead of using the undulating ring or spring 183 to fix the secondary flywheel mass 103 in position, leaf spring elements can be used for example, which are placed circumferentially between the secondary flywheel mass 103 and the axial piece 145a, and which can then exert pretensioned force in a radial direction. Apart from that it is possible to shape the support plate 146 in the region of its axial piece 145a into an approximately polygonal form. In this way the smallest inner diameter is less than the outer diameter of the secondary flywheel mass 103, so that the flywheel can be frictionally engaged and thus stopped from falling out.

30 A further possible embodiment of the torque transfer device in accordance with the invention is shown in Figure 4, which has the same or similar components and which uses similar numbers, but which are increased by a further 100.

35 In contrast to the divided flywheels previously described,

the divided flywheel as shown in this instance has the primary flywheel mass 202 designed as a cast part. Moreover, a hysteresis device 284 is displayed which is positioned between the primary side and the secondary side of the twin mass flywheel, and which causes friction damping. This friction damping may be effective over the whole of the torsional angle or equally over just part of the torsional angle, in which on the other hand it is possible to design the friction device 284 (which in this case is merely graphically represented) variously in the directions of push and pull.

In order to even out the wear an adjustment device 285 is shown, which amongst other things comprises a sensor spring 286, and which has its function and assembly described for example in the DE-OS 42 39 291, the DE-OS 42 39 289 and the German patent application P 43 22 677. Particular regard is given to this device and to its contents, which at least in this respect form part of the above application.

The secondary flywheel mass 203 is held with friction engagement in the pot formed by the axial piece 245a by means of the undulating spring or undulating ring 283, as has already been described in connection with Figure 3. There is an alternative mounting possible, which is similar to that previously described. The disengageable connection 266 - which is positioned between the support plate 246 and the clutch cover 247 - is designed in the same way as the other configurations given above, and is locked over the open wire ring 279. The wire ring is thus prevented by its angled ends 280 from turning in relation to the support 246.

The sensor spring 286 touches the plate spring 254 with

its inner radial region, and in so doing forms the pivot support pad 256 in which the sensor spring tensions the plate spring 254 in its pivot point, which itself points in the direction of the clutch cover 257. The sensor spring 286 is supported by its outer radial regions on the contact region 288 of support plate 246. With its axial pretensioned force the sensor spring pushes the support plate 246 and the clutch cover 257 away from each other in an axial direction and in such a way that this force is absorbed by the wire ring 279, which is then sealed as a result. In an engaged position, an axial force acting on the contact or friction regions 281 between the support plate 246 and the secondary flywheel mass. This axial force corresponds to the difference between the contact pressure force of plate spring 254 and the tensioned force of sensor spring 286.

Therefore with this arrangement a slip clutch is made, since the following components can be twinned circumferentially with respect to the support plate 246, as they are connected only with friction engagement: the secondary flywheel mass 203, the clutch cover 257 with pressure plate 252, plate spring 254 and sensor spring 286, as well as clutch disc 205. As the sensor spring 286 is likewise connected rotationally secured through recessed sections to the clutch cover 257, one of the friction surfaces of the slip clutch is positioned in the region of the contact area 288 and another friction surface is positioned on the opposite axial side of the cover 257 between this section of the cover 257 and the wire ring 279, which is itself rotationally secured with the support plate 246. The additional friction region 281 between the back pressure plate 203 and the support 246 can however convey the torque, which is proportional to the axial force acting on it. As already explained, the

friction regions can also be designed with friction linings or coatings.

5 Figure 5 shows another design possibility of a torque transfer device in accordance with the invention, for which the same or similar parts are used, and for which a similar numbering system is used, although it is increased by a further 100.

10 The divided flywheel 301 corresponds in its basic assembly to the twin mass flywheel 1 as originally described, but the disengageable connection 366 exhibits a somewhat different construction. While the positioning of wire
15 ring 379 is equivalent to that of the wire ring 79 in Figure 2, the undulating spring 377 is placed between the outer radial piece 387 of clutch cover 364 and the cover plate 346. In this way the clutch cover 364 and the cover plate 346 are both pretensioned directly to each other by means of the undulating spring 377, and they are locked
20 in an axial direction through the wire ring 379. In order to prevent the secondary flywheel mass 303 from falling out of the pot formed by the cover plate 346, retaining tongues 345c are designed in the axial section 345 of cover plate 346. These retaining tongues 345c are formed
25 by recessed sections built into the cover plate 346, and shaped pointing radially inwards before the secondary flywheel mass 303 is inserted. By means of pushing the secondary flywheel mass 303 into the pot formed by the cover plate 346, these retaining tongues 345c are shaped
30 radially outwards. The tongues then fix and frictionally engage the secondary flywheel mass 303, so that this connection in turn becomes a component of the slip clutch. The resilient design of the retaining tongues 345c can on the one hand have an effect on the friction moment of the
35 slip clutch and can, on the other hand, lead to a certain

amount of compensation of wear. With the friction clutch 304 in a disengaged position at least three retaining tongues 345c are necessary for the centering and axial retention of the secondary flywheel mass 303, although it can be useful to utilise a greater number of retaining tongues 345c.

In the configuration as shown, the cover 364 of the friction clutch 304 is designed as being divided in the region of its radial extension. The outer radial piece 387 of cover 364 is connected radially to the support plate 346 by means of the disengageable connection 366, and has radially inwards radial projections 387b which, viewed circumferentially, are bordered by radial recessed sections 387a. This means that radial projections 387b and radial recessed sections 387a alternate with each other circumferentially.

In the same way, the inner radial piece 389 of cover 364 contains radial projections 389b in its outer radial region. These projections are bordered by radial recessed sections 389a, so that here also radial projections 389b and radial recessed sections 389a - viewed circumferentially - alternate with each other. The outer radial piece 387 and the inner radial section 389 of cover 364 are therefore made preferably out of just one plate, so that the radial recessed sections 387a of the outer radial piece 387 of cover 364 are formed, by shaping the projections 389b on the inner radial piece 389 of cover 364 - and vice versa. In other words, this means that the outer radial piece 387 and the inner radial section 389 can be positioned inside one another after their division, similar to the spline shaft in a shaft hub connection, for example.

To form the cover 364 of the friction clutch 304, the outer radial piece 387 and the inner radial section 389 are off-set from each other by "the width of a tooth face" so that the respective radial projections 387b and 389b come to lie on each other. The radial sections 387 and 389 of cover 364, which are thus positioned on top of one another, are joined together in the region of their projections 387b and 389b with the help of connecting screws 390. This screw connection can be separated without destruction for example when repairs are needed due to wear, and can be reassembled after the repairs have been successfully carried out. The screwed-on position or operating state is shown here in Figures 5a and c, while Figure 5b depicts the cover 364 in its disassembled state.

The bearing flange 315 of the twin mass flywheel 301 has a collar 315c, which extends radially inwards and forms one of the surfaces facing the combustion engine, at which a dismantling tool (itself able to be inserted from the side remote from the combustion engine) can be used. This type of dismantling tool is supported axially at the collar 315c and enables the plate spring to be pretensioned, thus causing the clutch 304 to be in a disengaged position. This relieves the screw connection for example, which makes it easier to remove the connecting screws 390. Moreover, this type of dismantling tool can help to put the clutch 304 back into a disengaged position, for example in embodiments without a separated cover, so that the clutch disc 305 can be twisted. Therefore, when there are twin mass flywheels with a slip clutch, as have already been described, it is possible to relax the slip clutch by tensioning the plate spring 354, and then to twist the components forming the slip clutch opposite the support plate 346 or opposite the primary

flywheel mass 302. This has the result that recessed areas, which are designed in the clutch disc and in the plate spring, and which allow the insertion of a screwing-up tool, as described for example in Figure 1, can be re-aligned axially with the heads of the fixing screws so as to connect the twin mass flywheel to the crankshaft of a combustion engine. This collar or hub attachment 315c - like the separable cover 364 - is not limited to the embodiment shown in Figure 5, but can also be included in all other embodiments so for example even in the configurations in accordance with the German patent application P 43 20 381. This collar 315c is especially practical in embodiments of twin mass flywheels with a slip clutch, as the recessed areas or openings for the removal of the crankshaft screws do not have to be aligned after the commissioning of the unit or following the first operation of the slip clutch.

Figure 6 has components which are the same or are similar to those parts already described, and which are numbered in a similar way, although they are increased by a further 100.

The twin mass flywheel 401 shown in Figure 6 has a releasable connection 466 which is designed with a tension ring 491 for easier assembly and dismantling. The positioning of wire ring 479 is unchanged whilst the undulating spring or ring 477 is supported on the cover 464 on one side, and on the other side is supported on the cover plate 446 with the intermediary tension ring 491. The tension ring 491 is therefore positioned in an axial direction between the undulating spring 477 and the cover plate 464, as is shown in Figure 6.

In pressure plate 452 there are threaded bores 452a spread

out circumferentially, which align with transient bores 465a in the clutch cover 464. Tension screws 491a can be inserted through these transient bores 465a into the threaded bores 452a. Once the screw heads of the tension screws 491a have been positioned at the clutch cover 464, and when the tension screws 491a are screwed further into the threaded bores 452a, the pressure plate 452 is then moved against the force of the plate spring 454 in an axial direction onto the clutch cover 464, and is thus set in disengagement motion. When the pressure plate 452 has been put back a certain distance in an axial direction, a distance which must be greater than that of the regular clearance, the shoulder 452b which is attached radially outwards on the pressure plate 452 comes to rest on the inner radial region of the tension ring 491. Then, when the axial movement of the pressure plate 452 is continued by the tightening of the tension screws 491a, the tension ring 491 is moved in the direction of the clutch cover 464 and thus tensions the undulating spring 477, so that the disengageable connection 466 becomes increasingly relieved. Once the disengageable connection 466 has been completely relieved of all axial force of the undulating spring 477, the wire ring 479 can be simply removed. However, it can be sufficient to relieve the disengageable connection 466 of only part of the axial force acting upon it. Figure 6a shows the assembled unit, Figure 6b shows the tensioning process, and Figure 6c shows the divided unit. Figure 6d shows principally the same assembly, except that here the bores 452a and 465a lie radially in the region of the plate spring 454, while in the Figures 6a to c they are positioned outside of the diameter of the plate spring 454.

Further possible configurations of a torque transfer device in accordance with the invention are shown in

Figures 7a and 7b, in which similar numbers are used for the same or similar components, although the numbers are increased by a further 100.

5 In the designs shown in Figure 7 the cover 564 of the
friction clutch 504 engages round the secondary flywheel
mass 503 and is coupled to it in the axial region of the
secondary flywheel mass 503 by means of the disengageable
10 connection 566. In the embodiment as given in Figure 7a
the secondary flywheel mass 503 is supported on the cover
plate 546 on the side of the combustion engine, and the
cover plate in turn is supported on the cover 564 by the
wire ring 579. Therefore the cover 564, the cover plate
15 546 and the secondary flywheel mass 503 all have radial
recessed sections and radial projections, as has already
been described, so that they may be assembled together in
an axial direction. On the side of the secondary flywheel
mass 503 remote from the combustion engine, the secondary
20 flywheel mass is biased by the undulating spring 577 with
axial force on the combustion engine. For this, the
undulating spring 577 is supported on one side by the
secondary flywheel mass 503, and on the other side by the
clutch cover 564. The undulating spring 577 can, however,
25 be replaced by an equivalent form of the cover plate 546,
which itself can then produce spring force in an axial
direction by way of tongues which are in equivalent
positions and which are shaped axially out of the cover
plate surface. In this particular embodiment the
30 secondary flywheel mass 503 is supported on its side
remote from the combustion engine directly by the cover
564 of the friction clutch 504, and is pushed against the
clutch cover 564 over the spring tongues of the cover 546,
which themselves are supported on the cover 564 by the
wire ring 579, as is shown in Figure 7a.

For an arrangement in accordance with Figure 7b the secondary flywheel mass 503 is spring mounted in the cover 564 without the insertion of the cover plate 546. In this embodiment, the secondary flywheel mass 503 is screwed
5 onto the cover plate 546 by means of the screws 503a in the outer radial region of the flywheel. The screws are accessible through openings 563 in the primary flywheel mass 502, which can also help the ventilation.

10 Figure 8 shows another design possibility of a torque transfer device in accordance with the invention, in the form of a twin mass flywheel. Similar numbers have been used for the same or similar components, although the numbers have been increased by a further 100.

15 The embodiments already described all contain a bearing component, such as in Figure 1 the bearing 6 in the form of a rolling bearing or sliding bearing, which is positioned between the bearing flange 15 and the cover
20 plate 38 (the numbers all refer here to Figure 1). This component torsionally adjusts and centres the primary and secondary parts of the divided flywheel 1 to one another. A bearing of this sort is not included in the arrangement as shown in Figure 8, as in this embodiment the primary
25 and secondary parts of the divided flywheel 601 are adjusted to each other directly by the energy accumulators 610. In addition, the cover plates 638 and 646 - which are substantially adjusted to the contours of the energy accumulators 610 - rest radially outwards on the energy
30 accumulators 610, and are thus supported by the energy accumulators 610. The energy accumulators 610, in turn, are kept centred radially inwards by a guiding shell 692, which may be divided into several parts. This guiding shell 692 serves as a bearing shell and can also act as
35 protection against wear. The guiding shell 692 is fixed

on its inner radial by flanges 615 and 630 which are connected to the first flywheel mass 602. The interior space, which is formed by flanges 615 and 630 and also by cover plates 638 and 646, and in which the energy accumulators 610 and guiding shell 692 are located, is sealed by seals 649 and 650 (which in this instance are represented as components formed in a similar way to plate springs). The space is also at least partly filled with a lubricant. Therefore in the arrangement as shown here, and in addition to their basic function of storing energy, the energy accumulators 610 also assume the role of adjusting and centering in relation to each other the primary flywheel mass 602 and the secondary flywheel mass 603 with the connected friction clutch.

Figure 9 contains parts which are the same as or are similar to those previously described, and which are numbered in a similar fashion, although the numbers are increased by another 100.

The divided flywheel 701 is assembled in a similar fashion to the divided flywheel 601, except that the energy accumulators do not act as the bearing for the primary flywheel mass 702 and secondary flywheel mass 703. In this arrangement the primary and secondary parts of the twin mass flywheel 701 are mounted relative to each other by flange 793 and cover plate 738. Flange 793, which is in one piece at least in its axial direction, replaces the functions of flanges 615 and 630 in Figure 8 for example, and in this instance is produced as a sintered piece. Slide shoes 794 are positioned between the outer radial region of flange 793 and the adjoining section of cover plate 738 which mainly extends in an axial direction. Not only do these shoes ensure that the parts are exactly centred to one another, but they also reduce the amount

of wear by means of their sliding properties. These sliding surfaces or slide shoes 794 are mainly fixed to the three or more radial extensions of flange 793 by a positive locking for example, and are preferably made out of a synthetic material such as PE, PA or PEEK (and strengthened by fibres if necessary). In addition to their function of acting as seals, the seals 749 and 750 can be enlisted to prevent any wobbling occurring between the first flywheel mass 702 and the second flywheel mass 703, and in so doing they reinforce the centering function of the slide shoes 749. Also in Figure 9a the seal 750 is designed with a run-up face for the cover plate 738, in order that the cover plate 738 is pressed axially against this run-up face of the seal 750 by the resilient seal 749. In this instance the seal 750 is made as a piece of synthetic material. Figure 9b shows a two-piece seal 750, containing a machined metal part and a part like a plate spring, which is in turn positioned between the cover plate 738 and the flange 793. The remainder of the assembly corresponds with that already described above in connection with Figure 9a.

The bearing through the energy accumulators 610 and slide shoes 794, as described in connection with Figures 8 and 9, is not limited only to the embodiments shown. It can, for example, also be used in embodiments which are described in connection with the German patent application P-43 20 381.

The invention is not limited merely to the embodiments as shown and as described above. It also encompasses design variations which can be formed by the combination of individual features and elements as described above, with the various models. The applicant reserves the right to claim further features which are of great importance to

the invention, but which have so far only been disclosed in the description. In particular, reference will be made to the disclosed content of the German patent applications P 43 20 382, P 43 11 908, P 43 15 209, P 43 22 677 as well
5 as the DE-OS 42 39 289 and the DE-OS 42 39 291, to which special attention has been paid here and which form part of the disclosure of the above application.

10 This application is divided from copending application 9412227.2. which describes and claims apparatus for transmitting torque, comprising: a first flywheel connectable with a rotary output element; an engageable and disengageable friction clutch connectable with a rotary input element; a second flywheel rotatable with as
15 well as relative to said first flywheel about a common axis; and means for opposing rotation of said flywheels relative to each other including at least one damper having energy storing means acting in a circumferential direction of said flywheels, said at least one damper and
20 said friction clutch constituting a power train between said first flywheel and the input element, said power train including a slip clutch having means for separably coupling a first and a second component of the power train to each other and means for limiting the magnitude of
25 torque transmittable between said first flywheel and the input element in the engaged condition of said friction clutch.

CLAIMS

1. Apparatus for transmitting torque, comprising: a
first flywheel connectable with a rotary output element;
5 a second flywheel rotatable with as well as relative to
said first flywheel about a common axis and connectable
with a rotary input element; and means for opposing
rotation of said flywheels relative to each other
including at least one damper having energy storing means
10 acting in a circumferential direction of said flywheels,
said at least one damper constituting a torque path
between said flywheels, wherein the damper has at least
one input part and one output part, which carry abutment
regions for the energy storing means and the input part
15 of the damper is connected rotationally fast with the
first flywheel, wherein the first flywheel consists
essentially of a radial flange-like component, which
carries radially outwardly an axial projection extending
in the direction of the second flywheel as well as a
20 starter gear ring, and the second flywheel is at least
partly surrounded by the axial projection.

2. Apparatus for transmitting torque, comprising: a
first flywheel connectable with a rotary output element;
25 a second flywheel rotatable with as well as relative to
said first flywheel about a common axis and connectable
with a rotary input element; and means for opposing
rotation of said flywheels relative to each other
including at least one damper having energy storing means
30 acting in a circumferential direction of said flywheels,
said at least one damper constituting a torque path
between said flywheels wherein the first flywheel mass has
a radially extending flange-like component which carries
radially outwards at least one starter ring gear, wherein
35 the first flywheel mass is connectable by means of a

radially inner screw fastening with the rotary output element and the flange-like component has openings radially outside the energy storing means for fastening the second flywheel by means of fastenings which are mounted through the openings.

3. Apparatus for transmitting torque, comprising: a first flywheel connectable with a rotary output element; a second flywheel rotatable with as well as relative to said first flywheel about a common axis and connectable with a rotary input element; and means for opposing rotation of said flywheels relative to each other including at least one damper having energy storing means acting in a circumferential direction of said flywheels, said at least one damper constituting a torque path between said flywheels, wherein the apparatus (working from inwards radially outwards) has the following features:

- a bearing between the two flywheel masses
- fastening means for mounting the apparatus on the rotary output element
- the energy storing means of the damper
- a component of the second flywheel which has a friction surface for a clutch disc.

4. Device according to one of Claims 1-3 characterised in that the first flywheel mass is a sheet metal part.

5. Device according to Claim 2 characterised in that the fastening means are screws.

6. Device according to one of the Claims 2-5 characterised in that the fastening means are fastenable from the side of the first flywheel mass facing away from the second flywheel mass through the openings and into the

second flywheel mass.

5 7. Flywheel device comprising a first flywheel mass connectable with a drive and a second flywheel mass connectable with the first flywheel mass through a torsion vibration damper, the second flywheel mass being rotatable relative to the first flywheel mass and the clutch housing of a friction clutch being fitted on the second flywheel mass, the friction clutch having a rotationally fixed but
10 axially displaceable pressure plate, an energy storing means, such as a diaphragm spring, biasing the pressure plate and a clutch disc arranged between the pressure plate and a counter pressure plate, wherein at least the counter pressure plate which forms a component of the
15 second flywheel mass, the clutch disc, the pressure plate, the clutch housing and the energy storing means form a preassembled unit which is connectable as such by means of fasteners with a component provided on the first flywheel mass, wherein the first flywheel mass has
20 openings through which the fastenings can be tightened from the side of the first flywheel mass facing away from the second flywheel mass.

25 8. Device according to at least one of the preceding Claims, characterised in that the second flywheel mass is connectable through an engageable and disengageable friction clutch with the rotary input element.

30 9. Device according to at least one of the preceding Claims, wherein between the two flywheel masses, at least one hysteresis device is provided which is arranged radially outside the longitudinal axis of the energy storing means of the damper which acts between the two flywheel masses.

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10. Device according to at least one of the preceding claims, characterised in that the axial projection of the first flywheel mass is formed by an annular inertia ring which is fastened at the radially outer region of the flange like component.

11. Device according to Claim 10, characterised in that the inertia ring is made as a folded plate.

12. Device according to Claim 10 or Claim 11, characterised in that the inertia ring, considered in cross-section is angularly formed.

13. Device according to one of the Claims 10-12, characterised in that the inertia ring carries the starter ring gear.

14. Device according to at least one of the preceding claims, characterised in that the damper has an input part, rotationally connected with the first flywheel mass, as well as an output part rotationally connected with the second flywheel mass, wherein the rotational connection between the damper input part and the first flywheel mass lies radially inside the energy storing means of the damper, and the connection between the output part of the second flywheel is provided radially outside the energy storing means.

15. Device according to at least one of the preceding claims, characterised in that the two flywheel masses as well as the friction clutch carried by the second flywheel mass form one constructional unit.

16. Device according to any of the preceding claims, characterised in that the fastening means for connecting

the first flywheel mass with the rotary output element are integrated in the device and are secured against loss.

5. 17. Device according to at least one of the preceding claims, characterised in that a component of the damper which is biased by the energy storage means serves as a bearing between the two flywheel masses.

10 18. Device according to Claim 17, characterised in that the component has openings for receiving fastenings.

15 19. Device according to one of the preceding claims, characterised in that the friction clutch carried by the second flywheel mass has a diaphragm spring with radially inwardly directed tongues, and in the region of the tongues and/or in the region between the tongues, openings are provided for tightening of fasteners.

20 20. Device according to at least one of the preceding claims, characterised in that openings for tightening of fastenings are provided in a component of the clutch disc.



Application No: GB 9712813.6
Claims searched: 1, 4, and 8 to 18

Examiner: C J Duff
Date of search: 4 September 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

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Int Cl (Ed.6): F16F 15/12, 15/131, 15/133, 15/134, 15/136, 15/137, 15/139

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2277791 A (LUK LAMELLEN) Whole document	1, 4, 8-13, 15, 16
X	GB 2273334 A (FICHTEL & SACHS) Whole document	1, 4, 8, 10, 13, 15, 16
X	GB2273144 A (LUK LAMELLEN) Whole document	1, 4, 8, 10, 12, 15
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